THAILAND's Action Plan
to Reduce Aviation Emissions
version 2021

CAAT
สำนักงานการบินพลเรือนแห่งประเทศไทย
The Civil Aviation Authority of Thailand

"SHAPE THE NEW FUTURE WITH THAILAND GREEN AVIATION"

Photo by Capt. Supachat Varongsurat

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Executive Summary

Climate change is caused by an increase in greenhouse gas emissions. Although the aviation sector has a small share of greenhouse gas emissions, Thailand has joined to support policies that affect the international aviation sector through housing the International Civil Aviation Organization (ICAO).

Thailand submitted and published the first state action plan to ICAO in 2013 and the second in 2018. As a continuous work, Thailand's action plan in 2021, the third submission, is currently updated to demonstrate the progress in executing the old mitigation measures and the new mitigation measures which will contribute to the achievement of Thailand's emissions reduction goals aligned with ICAO's global aspirational goal and reflects the collaborative effort of various players and reaffirms the commitment of the Thailand's civil aviation industry to the environment. The Thailand's action plan will be consistently updated and submitted to ICAO every 3 years according to the 40th ICAO Assembly Resolutions.

Due to the spread of COVID-19 since 2019, the global aviation industry and Thai aviation industry has remained one of the hardest-hit industries. As for Thailand, it shows the decrease of 55 percent aircraft movements in 2020 when compared to the previous year. However, Thailand's aviation industry is expected to recover earliest in 2024. This expectation remains with uncertainty resulting from more variants of the COVID-19 virus. Although the full recovery has not been reached yet, the cooperation between all stakeholders, including for example air operators, airport operators, air navigation service providers and the Civil Aviation Authority of Thailand (CAAT), continues to reduce GHG emissions.

To ensure the achievement of 2021 Thailand's action plan, it is vital to incorporate the impacts of COVID-19 crisis particularly for evaluating emission baseline and reduction target and identifying emission mitigation measures. The engagement of Thai aviation stakeholders is considered as one of the main driving factors for the success of emissions mitigations measures implementation which is divided into 4 categories which are aircraft technology, airfield improvements, operational improvements and market-based measures. The expecting results of each after implementing mitigation measures in 2050 will be drawn to ensure the achievement of Thailand's target set and support ICAO's aspirational goals.

CHAPTER 1

Introduction

Photo by Capt. Supachat Varongsurat

1 Introduction

1.1 Background

At present, an increase in the amount of GHG emissions has led to climate change, which is mainly man-made especially when it comes to the combustion of industrial fuels. Despite the fact that the aviation sector has a small share of GHG emissions, based on the Intergovernmental Panel on Climate Changes (IPCC)[1] indicating that the global international and domestic aviation sectors account for only approximately 2 percent of the total emissions, there still exists a goal in which several countries have declared a desire to conserve energy and reduce GHG emissions. This is being done to ensure that global temperatures will not rise more than 2 degrees Celsius above pre-industrial levels before the year 2030.

As for supporting policies that affect the international aviation sector, ICAO developed standards and recommendations for aviation environment according to ICAO Annex16 Environmental Protection which determines that environmental performance is one of the Key Performance Areas (KPA)[2] of the air navigation system. Consequently, the reduction in fuel consumption and GHG emissions resulting from aircraft operations is required as one of the key metrics used to assess the efficiency and sustainability of air navigation system.

Additionally, the environmental performance is monitored through various performance reports. This includes the requirement of ICAO Member States to develop State Action Plan every 3 years to update the progress of GHG reduction measures implementation for international aviation and to show their commitment and contribution to ICAO's global aspirational goals of 2% annual fuel efficiency improvement and carbon neutral growth from 2020.

State Action Plan is a framework of action on climate change for the international aviation sector, involving all interested parties at national level. These parties are encouraged to work together to define a quantified baseline scenario, select appropriate emissions mitigation measures not only from ICAO's basket of measures but also from best practices successfully implemented, and calculate the expected results of implementing those measures. There are currently 121 states out of 193 ICAO Member States, representing 97.52% of global Revenue Tonne-Kilometers (RTK), voluntarily submitting the State Action Plan to ICAO, which has been officially published in ICAO Website https://www.icao.int/environmental-protection/pages/climatechange_actionplan.aspx. With the State Action Plan submitted, these reports will be a part of supporting for the achievement of ICAO's global aspirational goals with useful data and mitigation measures implementation.

Thailand, as one of the ICAO Member States, submitted the first State Action Plan in 2013 to exhibit the engagement of Thailand's aviation industry for emissions reduction. In 2018, Thailand's State Action Plan was updated to show the progress of emissions reduction measures implementation. At present, the third Thailand's State Action Plan has been developed to present the involvement and commitment of the aviation industry to support the ICAO's global aspirational goals.

1.2 Objective

The global outbreak of COVID-19 has severe impacts to Thailand's aviation industry. In addition to the sharp decrease of air travel demand, it influences the operators to rethink and reshape their business approaches/models from strategic and operational points of view. Nonetheless, Thailand remains the strong intention to continue the aviation emission reduction scheme. The experiences, practices and related data from the past to the present have been reviewed and incorporated for determining baseline, mitigation measures, emission reduction target and expected results. This is clearly shown in the updated version of Thailand's State Action Plan 2021 which will be used to guide and track path of actions important managing Thailand's aviation GHG emissions from 2021 onwards.

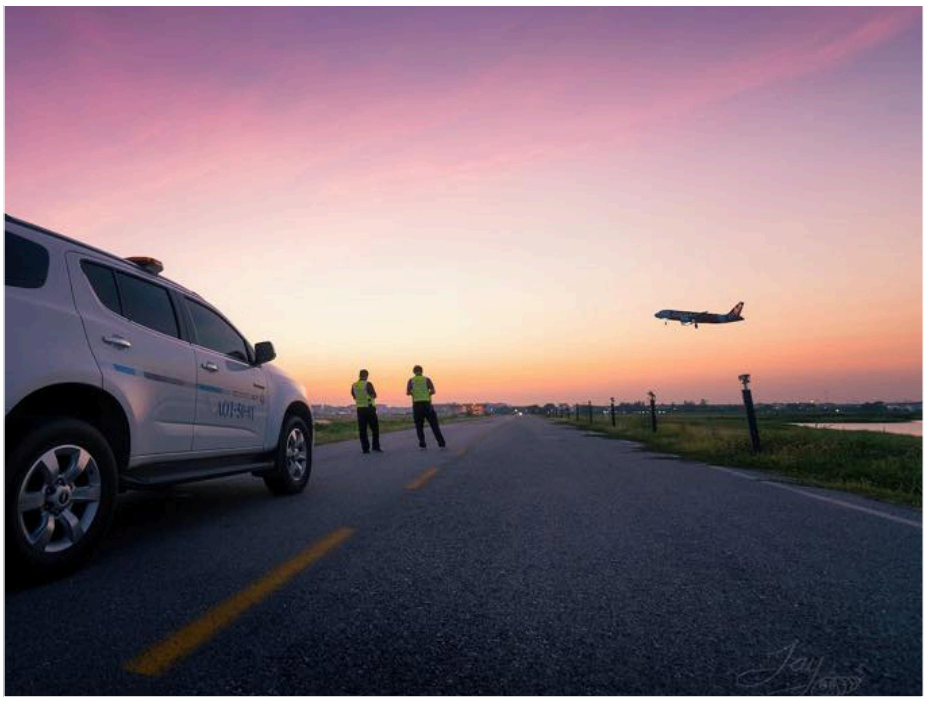

Photo by Mr. Nattanon Kanchak

1.3 Contact Information

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CHAPTER 2

Thailand’s Civil Aviation Information

Photo by Capt. Supachat Varongsurat

2 Thailand's Civil Aviation Information

2.1 Current Situation and the Path Forward

Overall, the Thailand's aviation industry which serve over 1 million flights and more than 165 million passengers in 2019, underline the potential/capacity of the industry as one of the region's leaders. Thailand has a total of 38 public airports, serving both domestic and international flights from more than 120 airlines around the world and providing air traffic services to aircraft under the Bangkok Flight Information Region (Bangkok FIR) or the airspace sector of Thailand (Figure 1).

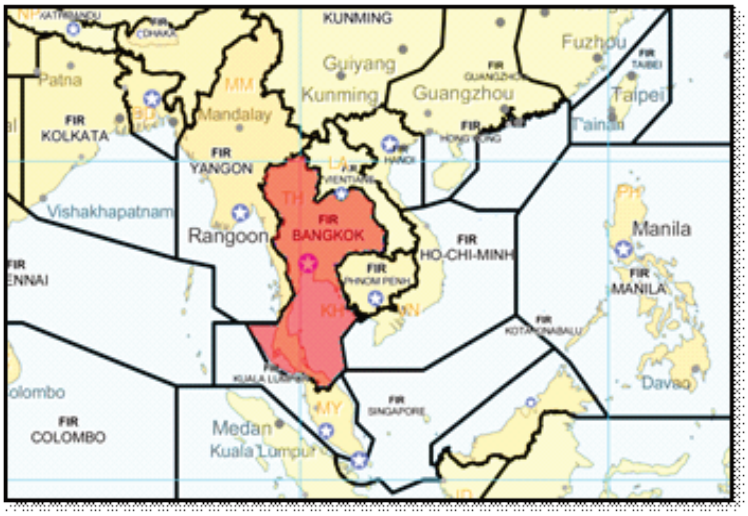


Figure 1: Bangkok Flight Information Region[3]

There are 25 Thai air operators which have Air Operator Certificate (AOC), including scheduled and non-scheduled air operators, which operate 663 Thai-registered aircrafts[4]. In current, 29 repair stations provide line and heavy maintenance services in Thailand. In addition, there are 17 aviation training institutes which have produced around 10,000 licensed aviation personnel[5]. In providing air transport services in a safely manner, it requires the collaboration of 3 main sectors which are Thai Air Operators, Air Navigation Service Providers, and Airport Operators.

2.1.1 Airport Operators

In 2019, Thailand had a total of 38 public service airports[6] in all regions of the country, operating by 4 airport operators (Figure 2). They are:

No.	Airport Operators	Logos
1	Department of Airports (DOA)	
2	Airports of Thailand Public Company Limited (AOT)	
3	Bangkok Airways Public Company Limited	
4	Royal Thai Navy (RTN)	

Licensed by Airports of Thailand

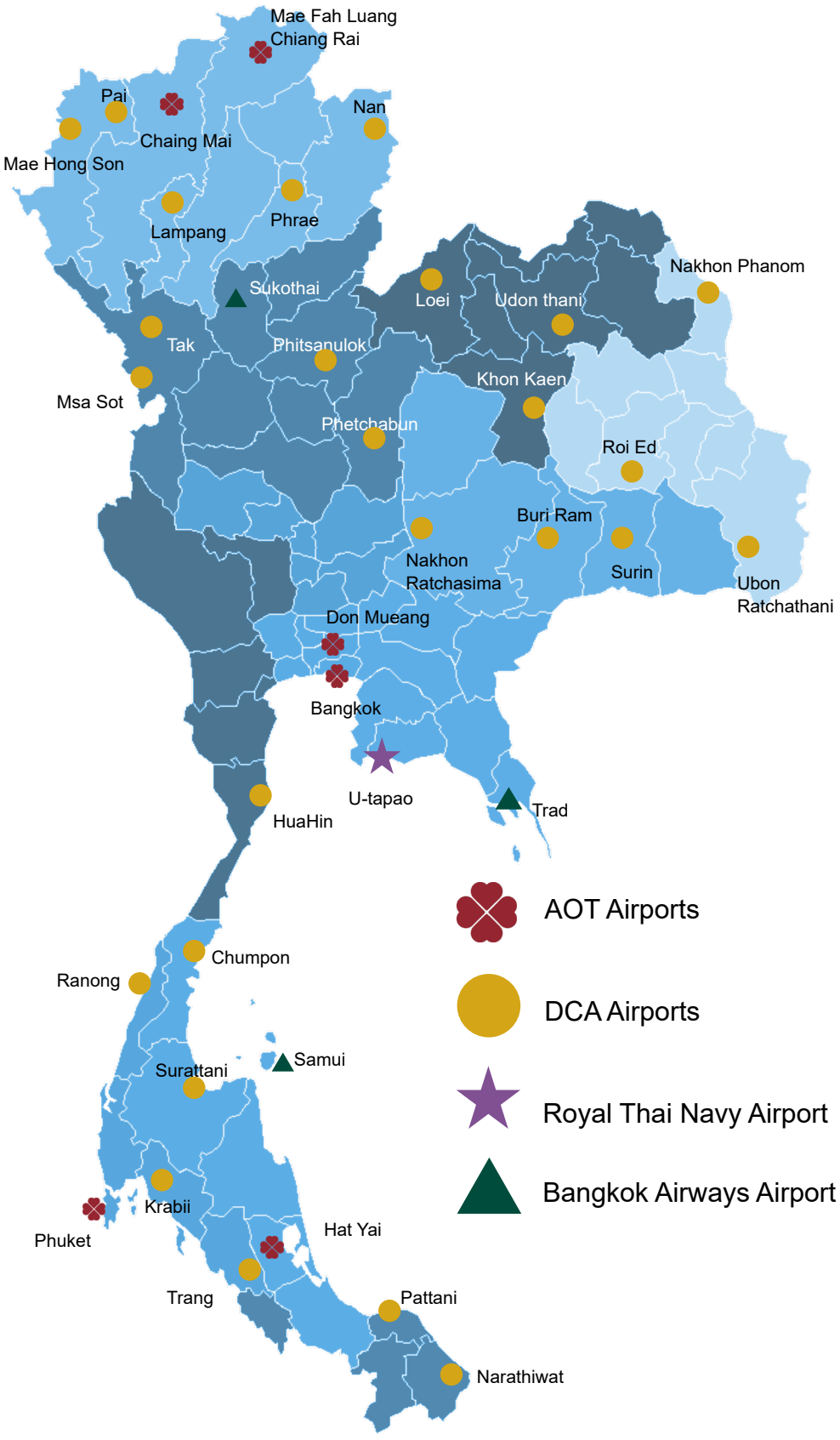


Figure 2: Airports in Thailand[7]

2.1.2 Air Navigation Service Providers

Air navigation services provided in Thailand include Air Traffic Management (ATM); Communications, Navigation, and Surveillance (CNS), Meteorological Service (MET), Aeronautical Information Service (AIS), Instrument Flight Procedure Design (IFPD), and Search and Rescue (SAR). There are 5 operators involved as follows:

No.	Air Navigation Service Providers	Logos
1	Aeronautical Radio of Thailand Limited (AEROTHAI)	
2	Royal Thai Navy (RTN)	
3	Thai Meteorological Department (TMD)	
4	Civil Aviation Authority of Thailand (CAAT)	
5	Office of the Search and Rescue Commission for Aircraft and Disaster	

2.1.3 Air Operators

There are 25 Thai air operators which are approved for the Air Operator Certificate (AOC)[8]. They are as follows:

No.	Air Operators	Logos
International - Airplane		
1	Bangkok Airways Public Company Limited	
2	Thai AirAsia Company Limited	
3	Thai Airways International Public Company Limited	

No.	Air Operators	Logos
International - Airplane		
4	Thai Air Asia X Company Limited	
5	Nok Airlines Public Company Limited	
6	Thai Smile Airaways Company Limited	
7	Thai Lion Mentari Company Limited	
8	Mjets Limited	
9	K-Mile Air Company Limited	
10	Thai Vietjet Air Joint Stock Company Limited	
11	AC Aviation Company Limited	
12	VIP Jets Company Limited	
13	Siam Land Flying Company Limited	
14	Advance Aviation Jet Company Limited	
15	Thai Summer Airways Company Limited	
16	Air Inter Transport Company Limited	
17	H.S. Aviation Company Limited	

No.	Air Operators	Logos
International - Helicopter		
18	United offshore Aviation Company Limited (Helicopter)	
19	SFS Aviation Company Limited (Helicopter)	
20	Bangkok Helicopter Services Company Limited (Helicopter)	
21	Thai Aviation Services Limited (Helicopter)	
22	Advance Aviation Company (Helicopter)	
Domestic - Airplane		
23	Asian Aerospace Services Company Limited	
24	Thai Flying Service Company Limited	
Domestic - Balloon		
25	Flying Media Company Limited (Balloon)	

In addition to the three main providers in the aviation industry mentioned above, there are other related providers that support Thailand's aviation industry. These include aviation training institutes which produce aviation personnel in various areas. Ground handling service providers support ground operations in airports and prepare aircraft for the safe operation. These services also cover maintenance repair stations which provide maintenance, repair and overhaul services to ensure safety and airworthiness of aircraft.

COVID-19

The spread of COVID-19 since 2019 has brought about changes at a critical level for the global and Thai aviation industry. As for Thailand, the total number of flights operated in 2020 was only 464,944 which was lower than the total number of 1,042,342 flights in 2019, accounting for 55 percent overall[9].

This includes a decrease in the number of passengers in 2020 by 64.7 percent or 58.25 million passengers, dividing into 81.7 percent decrease or 16.25 million passengers internationally and a 44.9 percent decrease or 42 million passengers domestically[10]. The hugely declining numbers of passengers are aligned with a decrease of 83.21% tourists in 2020 when compared to the previous year[11]. This damaged the country as a whole and this also led to detrimental effects on air operators, airport operators, air navigation service providers and other related entrepreneurs. To cope with the crisis from COVID-19, the operators have put efforts to reduce their operating costs as much as possible although some of the operators would not be able to maintain their businesses. Meanwhile, the government of Thailand has launched the financial supporting policy for the aviation industry. This includes for example the reduction of airport fees and air navigation services charges.

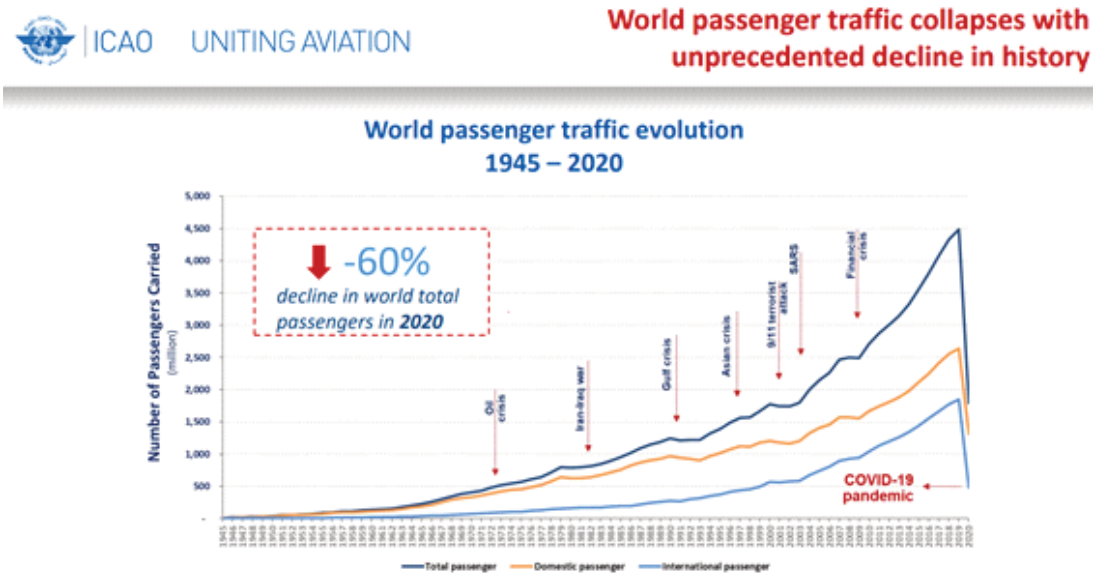


Figure 3: Evolution of air passenger traffic from 1945 - 2020[12]

Photo by Capt. Supachat Varongsurat

As shown in Figure 3, the aviation industry has repeatedly shown the resilience to come back stronger from external crisis such as 9/11 attack in 2001, SARS pandemic in 2003 and financial crisis in 2008. It is certain that Thailand's aviation industry will be recover from the COVID-19 crisis although it takes longer time than expected due to more infectious variants of the COVID-19 virus. In 2024, it is expected to serve over 1 million flights and more than 165 million passengers which equals to 2019 traffic. To promote the sustainable growth of Thailand's aviation industry onwards, numbers of development plans, including airport development plans, route development plans, and airline business plans, continues to execute. This supports the efficiency improvement of energy consumption and GHG emissions. Nonetheless, the impacts of COVID-19 crisis have been taken into account for evaluating emission baseline and reduction target and identifying emission mitigation measures, which is updated into 2021 Thailand's State Action Plan. Therefore, it can be said that the more efficient Thailand's aviation industry is, the greater the efficiency of Thailand's reduction in GHG emissions from aviation will become.

2.2 Thailand's Aviation Environment

The continued growth of the aviation industry impacted the environment in massive ways, both at the community and international levels.

These environmental effects have been caused by various factors such as travelling to/ from airports, electricity use in terminals, wastewater treatment, and continued use of jet fuel, etc.

The aviation sector as a pilot industry is continually looking for ways to manage environmental impacts in accordance with international standards. It also set operational goals by focusing on reducing the use of jet fuel which is the energy source that produces the highest greenhouse gas emissions of more than 50 percent. The target of the aviation sector should be consistent with the continued growth of air traffic volume. Therefore, at the 37th session of ICAO Assembly in 2010, the International Civil Aviation Organization (ICAO) endorsed 2 main "Global Reduction Target Goals" for the international aviation sector. Moreover, the reaffirmation was made at the 38th session of ICAO Assembly in 2013, the 39th session of ICAO Assembly in 2016, and the 40th session of ICAO Assembly in 2019 as follows[13]:

The ICAO's global aspirational goals

1) 2 percent annual fuel efficiency improvement through 2050

2) Carbon neutral growth from 2020 onwards (CNG 2020)

From the 37th session of ICAO assembly, '2020 Carbon Neutral Growth' goal has been set as the medium-term global aspirational target for ICAO member states and relevant organizations to have the close collaboration to strive for keeping the global net carbon emissions from international aviation from 2020 at the same level. This supports an exploration of the feasibility of a long-term global aspirational goal for international aviation.

To contribute to the ICAO's global aspirational goals, Thailand's aviation industry has been improving the operational measures through technology and procedure development predominantly. Air operators tend to use new developed aircraft technologies and other related technologies to improve their operational efficiency. Airport operators continue to improve their capabilities to serve more flights within the shorter time. In the meantime, air navigation service providers keep the progress of technology and route development with the aim to increase safety level as well as the airspace efficiency, leading to a reduction of environmental impact especially relevant to atmospheric aircraft emissions. However, the use of technology is only an aid in the operation. The most important thing is the cooperation between all stakeholders: air operators, airport operators, air navigation service providers, and CAAT. This leads to efficient operations due to the fact that the aviation sector has appropriate and consistent operational plans, including the clarity of the international aviation development plan and the country's strategic plans. These allow different agencies to use them as a planning guide and framework for achieving shared goals.

At the same time, there are some factors that hinder efficiency of operations. This has made it exceedingly difficult to meet fuel efficiency targets because of the challenges involved in increasing the volume of air traffic from business travelers and air freight. Moreover, the lack of government support, lack of data collection/ analysis which supports planning and effective development, and uncontrollable external factors- either from the epidemic situation of the coronavirus disease or other critical situations, will affect to the sensitive aviation industry. Eventually, it is the risk of airlines to face competition in the business so as to maintain or increase their market share.

These are the main factors inhibiting the implementation of the above-mentioned plans and possibility they could lead to the ultimate outcome of not being able to achieve said plans at all.

Therefore, it is important that all sectors cooperate in eliminating these factors or at the very least, attempt to decrease their impact as much as possible. If this can be achieved, it is believed that we will see good performance and reduce environmental impacts by reducing jet fuel consumption and greenhouse gas emissions so as to fulfill the goal of country.

CHAPTER 3
Baseline

3 Baseline

3.1 Conceptual Framework

In the preparation of baseline data on fuel consumption and CO_2 emissions, the conceptual framework recommended by ICAO is deployed to ensure the reliability for creating baseline data on fuel consumption and CO_2 emissions in the aviation sector.

Among the 3 methods[14], Method B seems to be fit well with the current situation of Thailand aviation industry which has more than 10 aircraft currently operating and at least 2 years of the historical data available. Thailand's baseline is developed from the following factors:

- The number of Thai-registered aircraft: there were 277 aircraft registered[15] of 11 Air Operators who submitted the data on fuel consumption and RTK in 2019.
- Availability of fuel consumption data and RTK: It was found that, until now, Thailand has 10 year statistical record of fuel consumption and RTK.

Moreover, those data to be used for baseline calculation have been proved its accuracy and completeness by the Aviation Climate Change Committee.

Figure 4 shows the process of creating baseline data using method B[16] which is comprised of the 6 following steps:

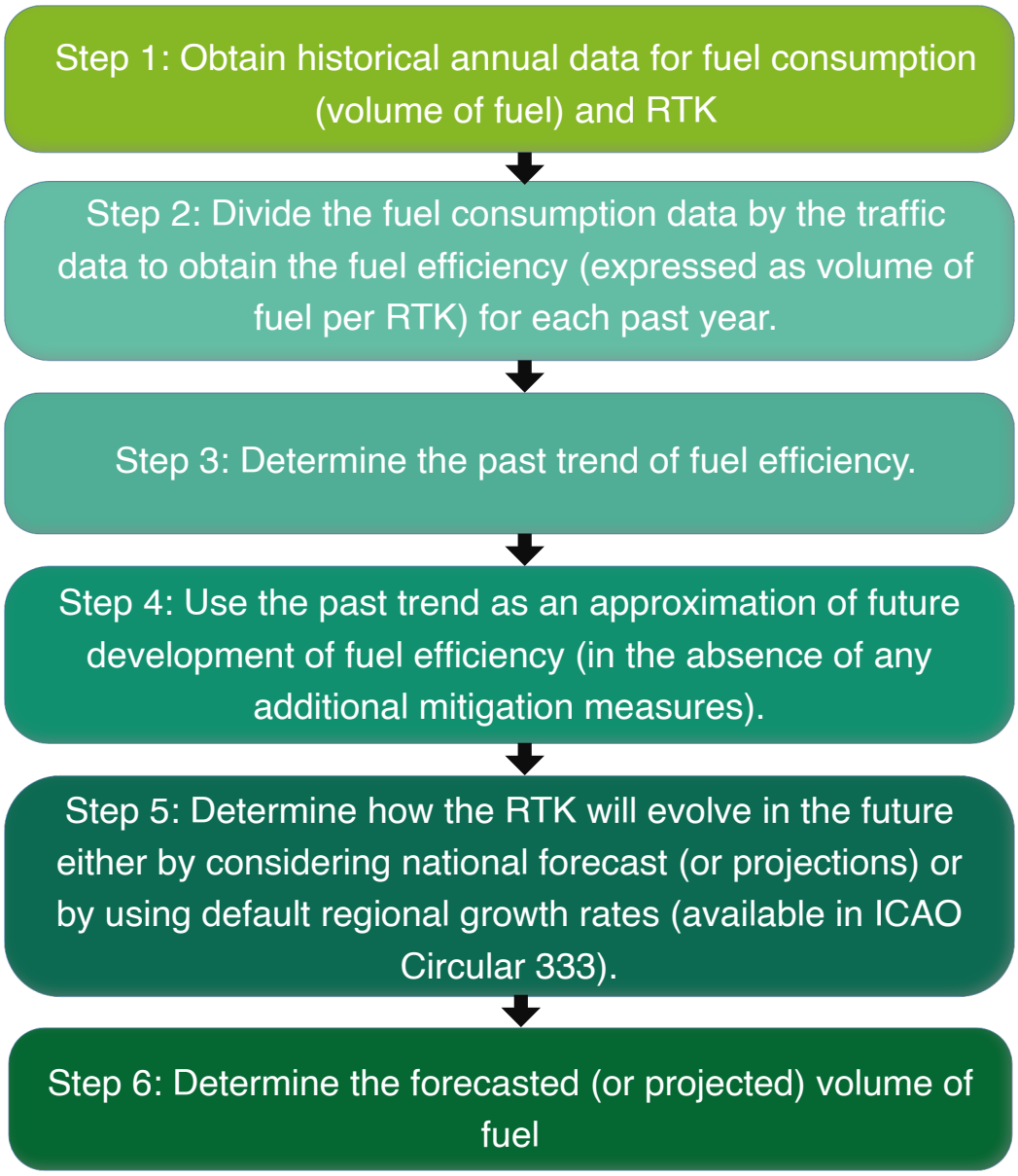


Figure 4: Preparation of Baseline Data: Method B

Thailand's historical annual data of fuel consumption and RTK in 2010 - 2019 are collected and evaluated that data to be fuel efficiency. To analyze the past trend of fuel efficiency by curve fitting and forecast fuel efficiency to 2050. To prepare RTK forecasting with worst case scenario, that air traffic will be recovery in 2024, it was found that in 2030, 2040, and 2050, RTK CAGR will be around 40.9%, 19.9%, and 13.9% respectively (After air traffic recovery in 2024, RTK CAGR will be around 6.9% in 2030, 4.9% in 2040, and 4.3% in 2050). Then, the forecasted volume of fuel consumption as equation:

$$\text{projected volume of fuel} = \text{projected fuel efficiency} \times \text{forecasted RTK}$$

3.2. MRV Systems

MRV systems are key mechanisms for tracking fuel consumption and CO_2 emissions. This is done to prove the success of implemented projects and measures under the Energy Conservation Policy to reduce GHG emissions at the national, organizational, and product levels. Therefore, in the development of MRV systems the following 5 basic principles must be taken into consideration.

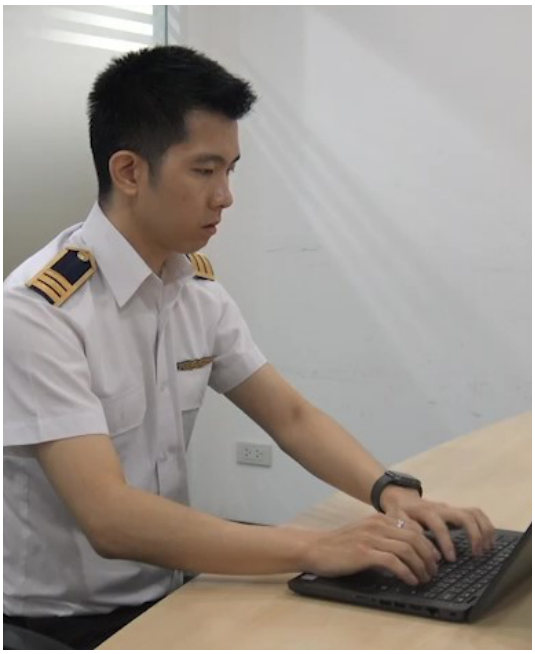
- Relevance of data which concerns the appropriateness of the measurement and computational methods to the goals of MRV system
- Completeness of the data used for measurement
- Consistency which concerns the same principle on which the methods of measurement, data collection and the calculations are based, so that the amounts of GHG emissions can be compared
- Transparency which concerns full disclosure and honesty of measurement, data collection, and calculation methods
- Accuracy which concerns the closeness of measuring methods, data collection and the amount of GHG emissions to the actual amount of GHG emissions

From MRV systems of the international aviation sector, the institutional structure of operation of such systems can be established (as shown in Table 1).

Table 1: Institutional Structure of MRV of the International Aviation Sector

Organizations	Roles and Responsibilities
International Civil Aviation Organization (ICAO)	Collect data.
Civil Aviation Authority of Thailand (CAAT)	Calculate and report the amount of greenhouse gas emissions.
	Collect and review the aviation fuel consumption data together with the transportation volume.
Air Operators	Report jet fuel consumption and ATK and RTK transport volumes.
	Measure jet fuel consumption and ATK and RTK transport volumes.

Every year, Thai air operators will measure, store, and report aircraft utilization data, jet fuel consumption data, and transport volume data such as Available Tonne-Kilometers or ATK and RTK in CAAT-M Form through the aviation emissions database of CAAT[17]. Before reporting, Thai air operators must verify the accuracy and completeness of all 3 types of information. Then, CAAT will be the agency that collects information from Thai Air Operators and performs a desktop audit of the implementation of energy use and GHG emissions (Inventory) in the international aviation sector. This is done to calculate the amount of greenhouse gases before compiling and reporting to ICAO.



CAAT ΣDMS

Emissions Data Management System

3.3 Thailand's Baseline

The preparation of baseline data is the result of forecasting fuel consumption of the international aviation sector without the implementation of mitigation measure (fuel consumption reduction and CO_2 emissions reduction) (Do-Nothing Additional) as far in the future as 2050. For Thailand, the baseline data on fuel consumption and CO_2 emissions in the Thai aviation sector is designed for the period of 2020 - 2050.

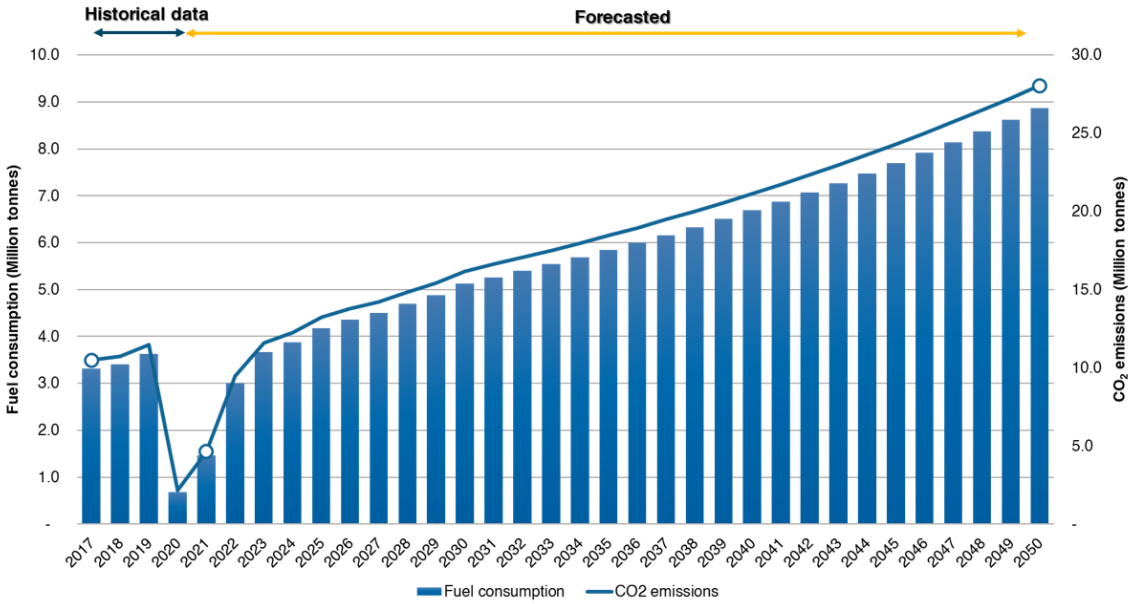


Figure 5: Baseline of international aviation fuel consumption and CO_2 emissions in 2021 - 2050

From the forecast of fuel consumption and CO_2 emissions in the international aviation sector for the years 2021 - 2050, it was found that in the next 10 years or by 2030, fuel consumption will be around 4.6 million tonnes and 14.6 million tonnes of carbon dioxide (tCO_2). Fuel consumption and fuel efficiency improvement account for a compound annual growth rate (CAGR) of 39.5% and 1.0%, respectively (After air traffic recovery in 2024, CAGR of Fuel consumption and fuel efficiency improvement will be around 6.0% and 0.9% in 2030).

An increase to 6.3 million tonnes for fuel consumption, 19.8 million tCO_2, 19.0% fuel consumption CAGR, and 0.8% fuel efficiency improvement CAGR in the next 20 years or by 2040 (After air traffic recovery in 2024, CAGR of Fuel consumption and fuel efficiency improvement will be around 4.2% and 0.7% in 2040).

When viewed from at 30-year perspective, it was found that in 2050, fuel consumption will be at 8.3 million tonnes, CO_2 emissions will be at 26.3 million tCO_2, 13.1% fuel consumption CAGR, and 0.7% fuel efficiency improvement CAGR (After air traffic recovery in 2024, CAGR of Fuel consumption and fuel efficiency improvement will be around 3.7% and 0.6% in 2050) as shown in Figure 5 and as details shown in Table 2.

Table 2: Baseline of international aviation fuel consumption, CO_2 emissions and RTK in 2021 - 2050

Years	Fuel consumption		CO_2 Emissions (Tonnes)	RTK (Tonne-Kilometers)
	(Liters)	(Tonnes)		
2010*	3,440,993	2,752,794	8,698,829	7,574,912
2011*	3,582,038	2,865,630	9,055,391	8,511,965
2012*	3,575,545	2,860,436	9,038,978	8,766,787
2013*	3,456,981	2,765,585	8,739,249	9,686,980
2014*	3,251,263	2,601,010	8,219,192	9,424,065
2015*	3,792,499	3,033,999	9,587,437	10,034,051
2016*	3,636,640	2,909,312	9,193,426	10,822,393
2017*	4,146,403	3,317,123	10,482,107	12,728,696
2018*	4,250,314	3,400,251	10,744,793	13,340,928
2019*	4,541,755	3,633,404	11,481,556	13,990,091
2020	800,901	640,721	2,024,679	2,535,333
2021	288,875	231,100	730,276	927,282
2022	2,003,499	1,602,799	5,064,846	6,514,082
2023	3,182,710	2,546,168	8,045,891	10,471,543
2024	4,074,048	3,259,238	10,299,193	13,552,952
2025	4,489,549	3,591,640	11,349,581	15,090,204
2026	4,755,543	3,804,435	12,022,014	16,140,060
2027	5,128,811	4,103,048	12,965,633	17,566,830
2028	5,349,465	4,279,572	13,523,447	18,481,791
2029	5,524,870	4,419,896	13,966,870	19,245,091
2030	5,772,686	4,618,149	14,593,351	20,265,914
2031	6,004,436	4,803,549	15,179,214	21,236,992
2032	6,307,938	5,046,350	15,946,467	22,469,687

Table 2: Baseline of international aviation fuel consumption, CO_2 emissions and RTK in 2021 - 2050 (Contiue)

Years	Fuel consumption		CO_2 Emissions (Tonnes)	RTK (Tonne-Kilometers)
	(Liters)	(Tonnes)		
2033	6,484,661	5,187,729	16,393,223	23,257,028
2034	6,656,953	5,325,563	16,828,778	24,031,399
2035	6,835,574	5,468,459	17,280,332	24,831,554
2036	7,020,651	5,616,521	17,748,205	25,658,350
2037	7,212,322	5,769,858	18,232,751	26,512,676
2038	7,410,740	5,928,592	18,734,351	27,395,448
2039	7,616,066	6,092,853	19,253,414	28,307,613
2040	7,828,473	6,262,778	19,790,380	29,250,149
2041	8,048,145	6,438,516	20,345,709	30,224,068
2042	8,275,274	6,620,219	20,919,892	31,230,415
2043	8,510,064	6,808,051	21,513,441	32,270,270
2044	8,752,727	7,002,182	22,126,894	33,344,747
2045	9,003,486	7,202,789	22,760,814	34,455,001
2046	9,262,574	7,410,059	23,415,786	35,602,222
2047	9,530,231	7,624,185	24,092,423	36,787,641
2048	9,806,709	7,845,367	24,791,361	38,012,531
2049	10,092,270	8,073,816	25,513,259	39,278,204
2050	10,387,186	8,309,748	26,258,805	40,586,019

Remarks: 1. * Historical Data

2. The figures that are shown in the table are rounded results

CHAPTER 4

Mitigation Measures

4 Mitigation Measures

There are 4 groups of emissions mitigation measures implemented by Thailand's aviation industry. According to aircraft technology improvement, airfield improvement, operational improvement and market-based measures, as follows.

4.1 Aircraft Technology Improvement Measures

Aircraft technology development measures are those measures using advanced technology for modifying aircraft or improving aircraft efficiency per unit, resulting in decreasing CO_2 emissions.

The aircraft technology development measure group consists of two sub-measures: expansion aircraft fleet with new aircraft and purchase of new aircraft to replace the old aircraft.

4.1.1 Expansion Aircraft Fleet with New Aircraft Measure

Title	Expansion aircraft fleet with new aircraft
ICAO Category	Technology and standards
Description	Expansion aircraft fleet with new aircraft is the measure related to purchase of new aircraft with improved combustion efficiency. As a result, the rate of jet fuel consumption per unit of output or Specific Fuel Consumption (SFC) is decreased, resulting in the reduction of overall use of jet fuel in the fleet.
Limitation of Action	The budget for aircraft purchasing and aircraft utilization plan are key constraints for implementing the measures.
Status	On-going
Assistance Needed	N/A
Implementation Progress	Year 2021
Implemented by	K-Mile Air Co., Ltd.
Action	Additional purchase of B737-800BCF aircraft
Start Date	N/A
End Date	Within 2025

4.1.2 Purchase of New Aircraft to Replace the Old Aircraft Measure

Title	Purchase of new aircraft to replace the old aircraft		
ICAO Category	Technology and standards		
Description	Purchase of new aircraft to replace old aircraft is a measure related to the purchase of new aircraft with better combustion efficiency as a replacement for old aircraft. As a result, fuel consumption has been decreased.		
Limitation of Action	The budget for aircraft purchasing and aircraft utilization plan are key constraints when it comes to implementing the aforementioned measures.		
Status	On-going		
Assistance Needed	N/A		
Implementation Progress	Year 2013	Year 2018	Year 2021
Implemented by	Thai AirAsia Co., Ltd.	Thai Airways International Public Co., Ltd.	Thai AirAsia Co., Ltd.
Action	Buying Airbus A320-200neo to replace the old A320-200 aircrafts in the fleet.	The purchase of 12 new aircraft models replacing the existing ones (Purchase of new Airbus A350 carriers)	Replacement of A320 with A320NEO
Start Date	Mid of 2016	2 carriers were delivered at the end of 2016 5 carriers are scheduled to be delivered by the end of 2017 5 carriers are scheduled to be delivered by the end of 2018	N/A
End Date	Onward to replace A320-200 in the feet*	Fully implementation by middle of 2019	Within 2025
Remark: *As of the end of 2017, however, the old A320-200 aircrafts have not been replaced by new ones. They are still in use with the addition of 4 newly ordered aircrafts to the fleet.			

4.2 Airfield Improvement Measures

Airfield improvements are those investment measures designed to improve aircraft movement on ground through the additional construction of runways, taxiways or taxiway exits and/or speed-exits, reducing the time required by aircraft during taxi phase operations. This has resulted in lower CO_2 emissions.

4.2.1 Construction of Runways and/or Taxiways Measure

Title	Construction of runways and/or taxiways			
ICAO Category	Operational improvements			
Description	Construction of runways and/or taxiways is a measure related to infrastructure within the airside, resulting in a change in taxi routes. This has also lead to a decrease in the average time spent during taxi phase and a decrease in the consumption of jet fuel.			
Limitation of Action	The construction budget is a major constraint for implementing the measures.			
Status	On-going			
Assistance Needed	N/A			
Implementation Progress	Year 2018	Year 2021		
Implemented by	Airports of Thailand Public Co., Ltd.	Airports of Thailand Public Co., Ltd.	Department of Airports	U-Tapao Airport Authority
Action	Construction of a new runway (3rd runway) at Suvarnabhumi airport	Construction of a new runway (3rd runway) at Suvarnabhumi airport	Construction of parallel taxiways and express exits at Krabi airport	Construction of additional taxiways at U-Tapao airport
Start Date	2017-2019: document preparation, EIA and authorization phase 2020: construction start 2022: full implementation	N/A		
End Date	2023	Within 2023	Within 2022	Within 2022

4.3 Operational Improvement Measures

Operational improvements are measures designed to improve the operations of aircraft to reduce the consumption of jet fuel in each flight. This results in lower CO_2 emissions.

The operational improvement measure group consists of 7 sub-measures: minimizing weight, engine wash, PACK OFF - take off phase, single engine taxi, optimum flap/ reduce flap, and reduce reverse/ idle reverse thrust.

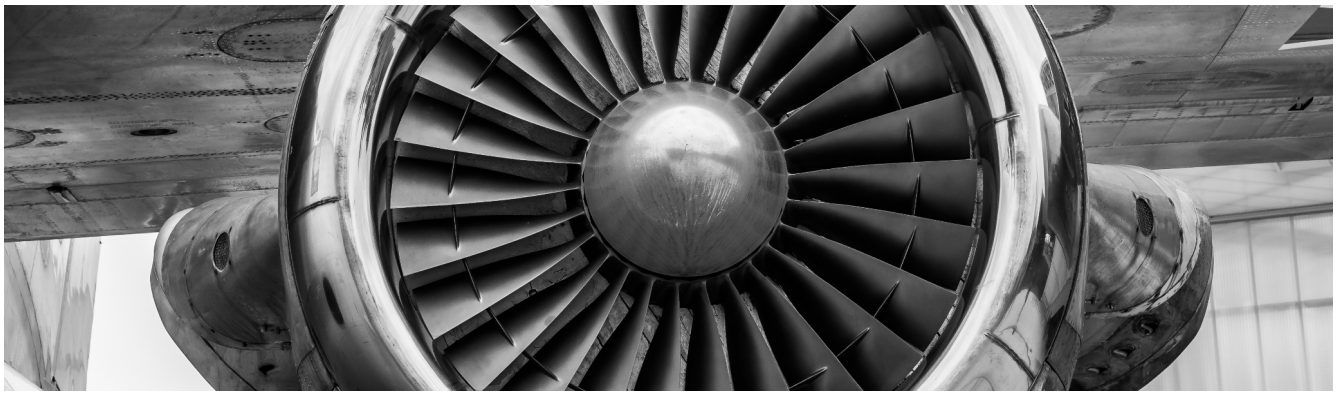
4.3.1 Minimizing Weight Measure

Title	Minimizing weight
ICAO Category	Operational improvements
Description	The minimizing weight measure is designed to reduce load weight, such as: • Reduce fuel uplift by planning the aircraft's payload close to actual usage or using accurate systems or information to prepare flight plan • Reduce potable water quantity in aircraft • Reduce the weight of the aircraft by replacing manuals and charts with Electronic Flight Bags (EFB). When the overall load weight decreases, the amount of jet fuel consumed will also decrease. As a result, the amount of jet fuel used in transportation will also decrease, resulting in lower greenhouse gas emissions.
Limitation of Action	N/A
Status	On-going
Assistance Needed	N/A

Implementation Progress	Year 2013	
Implemented by	Thai Airways International Public Co., Ltd	- Thai Airways International Public Co., Ltd - Bangkok Airways Public Co., Ltd.
Action	Flight Planing retune to reduce fuel uplift before flight	Designed to reduce Portable water as follow by the Water Loading Matrix table
Start Date	August 2011	20 August 2012
End Date	March 2013	N/A
Implementation Progress	Year 2018	
Implemented by	Bangkok Airways Public Co., Ltd.	
Action	Substitution of paper manuals with Electronic Flight Bag (EFB) one to decrease weight onboard.	Substitute outdated heavy seats (around 15 kg each) in economy class of A319 and A320 fleet with new lighter and more ergonomic ones
Start Date	2017: Permission Phase 2018: Start Implementation	2018: Start Implement 2019: Full Implementation
End Date	Fully implementation by 2020	Fully implementation by 2019
Implementation Progress	Year 2021	
Implemented by	- Thai Vietjet Air Joint Stock Co., Ltd. - Bangkok Airways Public Co., Ltd. - Thai Airways International Public Co., Ltd. - Thai Smile Airways Co., Ltd. - Thai Lion Mentari Co., Ltd.	- K-Mile Air Co., Ltd. - Thai AirAsia Co., Ltd. - Thai AirAsia X Co., Ltd.
Action	1. Reduce fuel uplift with the following procedures • Reduce aircraft tanker loading by planning the aircraft's payload to be close to actual usage. • Reduce aircraft tanker loading by using accurate systems or information to prepare flight plans. • Reduce the tanker loading from the pilot's additional fuel order (Reduce extra fuel) 2. Reduce potable water quantity in aircraft 3. Reduce the weight of the aircraft by replacing manuals and carts with Electronic Flight Bags (EFB).	
Start Date	2021	
End Date	N/A	

4.3.2 Enging Wash Measure

Title	Engine wash	
ICAO Category	Operational improvements	
Description	The engine wash measure is implemented to increase aircraft engine performance due to the accumulation of stains on the engine's turbines. This reduces engine performance and results in a higher Exhaust Gas Temperature (EGT). Regular engine wash can help remove stains on the engine's turbines, thus improving the engine's performance	
Limitation of Action	N/A	
Status	On-going	
Assistance Needed	N/A	
Implementation Progress	Year 2013	Year 2021
Implemented by	Thai Airways International Public Co., Ltd.	- Thai AirAsia Co., Ltd. - Thai Airways International Public Co., Ltd. - Thai Smile Airways Co., Ltd.
Action	Aircraft and engine wash	Engine wash
Start Date	1 January 2011	2021
End Date	N/A	N/A



4.3.3 PACK OFF – Take-Off Phase Measure

The Pack OFF during take-off phase measure is the operation procedures for shutting down air conditions during take-off to reduce engine load while taking off, resulting in a decrease in jet fuel consumption. Currently, there have been no major blockages when it comes to implementing these measures.

Title	PACK OFF - take off phase
ICAO Category	Operational improvements
Description	The pack off during take-off phase involves the operation procedures for shutting down air conditions during take-off to reduce engine load while taking off, resulting in a decrease in jet fuel consumption
Limitation of Action	N/A
Status	On-going
Assistance Needed	N/A
Implementation Progress	Year 2021
Implemented by	- Thai AirAsia Co., Ltd. - Thai Vietjet Air Joint Stock Co., Ltd.
Action	Air condition shutdown during take-off
Start Date	2021
End Date	N/A

4.3.4 Single Engine Taxi Measure

Title	Single engine taxi	
ICAO Category	Operational improvements	
Description	The single engine taxi measure is performed during taxi procedures based on using half of the installed number of engines for the taxi duration: single-engine power for the aircraft with 2 engines and two-engine power for the aircraft with 4 engines, resulting in a decrease in aircraft fuel consumption.	
Limitation of Action	According to traffic congestion in the airside, the suitability of airport infrastructure and aircraft performance are important limitations in the implementation of said measures.	
Status	On-going	
Assistance Needed	N/A	
Implementation Progress	Year 2013	Year 2021
Implemented by	Bangkok Airways Public Co., Ltd.	- Thai AirAsia Co., Ltd. - Bangkok Airways Public Co., Ltd. - Nok Airlines Public Co., Ltd. - Thai Lion Mentari Co., Ltd. - Thai Smile Airways Co., Ltd. - Thai Vietjet Air Joint Stock Co., Ltd.
Action	One Engine Taxi-in Campaign	Taxiing with single-engine power for the aircraft with 2 engines and two-engine power for the aircraft with 4 engines
Start Date	N/A	2021
End Date	N/A	N/A

4.3.5 Optimum Flap/Reduce Flap Measure

Title	Optimum flap/ reduce flap	
ICAO Category	Operational improvements	
Description	The optimum flap/ reduce flap measure relates to adjusting flap level in an appropriate position responding to phase of flight, known as Flap 3, to reduce resistance during approach phase. This contributes to reduced jet fuel consumption.	
Limitation of Action	This operation will result in the aircraft requiring more runway distances to reduce speed and exit to the taxiway, therefore sufficient runway length is a major limitation for implementing said measures.	
Status	On-going	
Assistance Needed	N/A	
Implementation Progress	Year 2018	Year 2021
Implemented by	- AirAsia Group - Thai Lion Mentari Co., Ltd. - Nok Airlines Public Co., Ltd. - Bangkok Airways Public Co., Ltd	- Thai AirAsia Co., Ltd. - Thai Smile Airways Co., Ltd. - Thai Vietjet Air Joint Stock Co., Ltd. - Bangkok Airways Public Co., Ltd.
Action	Reduced Flap landing	Using flap in the appropriate position or Flap 3 during approach phase
Start Date	From 2017	2021
End Date	Fully implementation by 2020	N/A

4.3.6 Reduce Reverse/Idle Reverse Thrust Measure

Title	Reduce reverse/ idle reverse thrust
ICAO Category	Operational improvements
Description	The reduce reverse/ idle reverse thrust measure is a flight operation designed to reduce the use of thrust reverser or use the reverse thrust idle during landing phase. This contributes to reduced consumption of jet fuel during landing.
Limitation of Action	Adequate runway length is an important limitation for implementing measure.
Status	On-going
Assistance Needed	N/A
Implementation Progress	Year 2021
Implemented by	- Thai AirAsia Co., Ltd. - Thai Smile Airways Co., Ltd.
Action	Reduce reverse / idle reverse thrust during landing
Start Date	2021
End Date	N/A

4.4 Market-Based Measures (MBM)

The MBM is a policy measure designed to achieve environmental goals at a low cost and is more flexible in terms of implementation than normal measures.

The MBM group consists of one sub-measure: Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

4.4.1 Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) Measure

Title	Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)
ICAO Category	Operational improvements
Description	The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a compensation and reduction program for carbon dioxide emissions in the international aviation sector. It is a form of Global MBM measures to stabilize international aviation carbon dioxide emissions at similar equivalent levels of emissions in 2020 (Carbon neutral growth from 2020 onwards (CNG 2020)). It is also in accordance with the goals of the International Civil Aviation Organization (ICAO).
Limitation of Action	N/A
Status	On-going
Assistance Needed	N/A

Implementation Progress	Year 2018	Year 2021
Implemented by	CAAT, Thai Air Operators	CAAT, Thai Air Operators
Action	Application of carbon offsetting mechanism to support ICAO towards carbon neutral growth	Monitoring, Reporting, Verification and Offsetting
Start Date	2017-2020: Training phase for all involved stakeholders, structure, dedicated system and ad hoc registry preparation 2021-2023: Pilot Phase 2024-2026: First Phase 2027-2035: Second Phase	2019-2020: Baseline Period 2021-2023: Pilot Phase 2024-2026: First Phase 2027-2035: Second Phase
End Date	Ongoing process	N/A

CHAPTER 5

Expected Results

5 Expected Results

5.1 Quality of Data

MRV system of emissions mitigation measures (MRV of Mitigation Actions) in the Thai aviation sector was developed to track and report on the success of measures taken under the emissions reduction policy. This has been carried out through calculating the amount of CO_2 emission reductions, based on the principle known as "SMART". This means that the indicator must be Specific, Measurable Accurate, Realistic, Time-bound. Besides, the balance between measurement costs such as human resources, time, complexity of data collection, and the accuracy of the calculated results are also taken into consideration so as to maximize the benefits of operations.

Photo by ThePhugetNews

Unlike the system for monitoring the performance of individual measures for energy conservation and greenhouse gas emissions, which is primarily based on the bottom-up method, the overall measurement of greenhouse gas emissions from the aviation sector is based on the top-down method. This is because such methods are a standard tool for measuring the amount of greenhouse gas emissions at the largest level. They are suitable for measurement to track and report greenhouse gas emissions of the national inventory sector. The bottom-up method, on the other hand, marks the measurement of individual details which is appropriate for the analysis of technological or policy change[18].

Therefore, in order to collect information that will be useful in formulating policies and tracking the success of implementing various measures, the bottom-up method has been selected to monitor the performance of individual energy conservation and greenhouse gas reduction measures. As for the top-down method, it has been selected to monitor overall performance of energy conservation and greenhouse gas reduction in the aviation industry in Thailand. Both methods contain the same five basic goals, especially completeness and transparency that can compare the performance of activities to provide feedback on improving the quality of data used to assess greenhouse gas emissions.

Thai air operators, air navigation service providers, and airport operators will monitor, store and report energy conservation and emission reduction in aviation emissions on each measure every year by May 31st. This will be done through the CAAT ENVI form or through central email of the Aviation Environment Division, Aerodrome Standards Department, CAAT or through the Aviation Greenhouse Gas Database System of CAAT. Before reporting, Thai air operators, air navigation service providers and airport operators shall verify the accuracy and completeness of the data. Then, CAAT will be the agency that collects data and performs a desktop-audit of energy conservation and emissions reduction in Thailand, as well as reporting its performance to ICAO through the State Action Plan.

5.2 Thailand's Next Step

In the potential assessment, the measures already in operation will be double counting with the assessment in the preparation of baseline data, which will result in a higher reduction in fuel consumption and CO_2 emissions than it should be. Therefore, the potential assessment will only be based on the number of flights expected to be carried out in addition to the current one. This is based on the assessment in conjunction with the ability to take additional measures from the present and the growth rate of flight volume during the year. The likelihood of these measures being implemented is expected to increase up to 5 percent from the current level.

As for air traffic management improvement measures and route improvements by Extended-range Twin-engine Operations Performance Standards (ETOPS), no stakeholder was found to have any plans to extend or further implement measures to airports or other routes by 2025[19]. Therefore, the measures in this group will not affect the future consumption of jet fuel, including the measures related to Uni-Directional Route/ Parallel Route / Conditional Route (CDR), Intelligent Departure Enhancement Program (iDEP), Ground Delay Program (GDP), and Route Improvement by Extended-range Twin-engine Operations Performance Standards (ETOPS).

The assessment of measures with the potential to reduce jet fuel consumption and aviation emissions during 2021 - 2025 can be shown in Table 3.

Table 3: Assessment results of mitigation measures with the potential to reduce fuel consumption and CO_2 emissions during 2021 - 2025

Groups	Mitigation Measures	Current execution status before 2021	Inclusion of measures in assessment	Measure execution potential, Year 2021 - 2025
I (New Measures)	Expansion Aircraft Fleet with New Aircraft Measure	0%	×	100%
	Purchase of New Aircraft to Replace the Old Aircraft Measure	0%	×	100%
	Construction of Runways and/or Taxiways Measure	0%	×	100%
II (Already Implemented but not Completed Measures)	PACK OFF - Take Off Phase Measure	<100%	O	5%
	Optimum Flap/ Reduce Flap Measure	<100%	O	5%
	Reduce Reverse / Idle Reverse Thrust Measure	<100%	O	5%
	Single Engine Taxi Measure	<100%	O	5%
	Minimizing Weight Measure	<100%	O	5%
	Engine Wash Measure	<100%	O	5%
III Completed Measures)	iDEP Measure	100%	✓	0%
	Ground Delay Program (GDP) Measure	100%	✓	0%
	Parallel Route/ Uni-directional Route/ CDR Route Measure	100%	✓	0%
	Route Improvements by ETOPS Measure	100%	✓	0%

Remark :

× The results of the implementation of the measures were not included in the evaluation of the baseline data.

O Some of the results from the implementation of the measures were included in the evaluation of baseline data.

✓ Some of the results from the measure implementation were included in the evaluation of baseline data.

From the table above, the measures in Group I (new measures) and Group II (already implemented but not completed measures) are the measure groups which have the potential to reduce the use of fuel consumption and CO_2 emissions. During 2021 - 2025, they will be used to assess the fuel consumption that has changed or decreased from the baseline. This makes Thailand establish the goal of reducing CO_2 emissions in the international aviation sector during 2021 - 2025 which concerns the improvement of fuel consumption potential from international aviation at the rate of 0.3 percent compared to the baseline.

Photograph by กัปตัน หม่อมหลวง บวรชัย วรวรรณ Callsign: mommam

5.3 Thailand's Expected Results

The evaluation of energy conservation potential and reduction of greenhouse gases in the Thailand's aviation sector during 2021 - 2050 is based on potential assessments from 2021 to 2025. Regarding to this, the information or details of the implementation of the measures of stakeholders during such periods must be considered. After 2025, there is a relatively high level of uncertainty in the implementation of the measures. Moreover, there is a chance that the potential for measures to significantly reduce the use of fuel or CO_2 emissions than current measures are introduced to reduce the likelihood of discrepancies.The potential assessment during this period will be based on Thailand's aviation energy conservation and greenhouse gas reduction targets for 2021 - 2025.

In the potential assessment of energy conservation and greenhouse gas reduction of the international aviation sector during 2021 - 2050, the fuel consumption reduction target at 0.30 percent of international aviation sector during 2021 - 2025 was used. It was found that in 2050, the potential to reduce fuel consumption and CO_2 emissions will reach approximately 484,287 tonnes and 1,530,346 tCO_2, respectively, as shown in Table 4.

Table 4: Summary of expected results for reducing fuel consumption, CO_2 emissions, and improving fuel efficiency of International Aviation Sector as of 2050

Summary of International Aviation Potential Assessment as of 2050	
Jet fuel Consumption (Tonnes)	
- Before implementing the baseline measure	161,293,228
- After implementing the measures	160,808,941
- Reduced jet fuel consumption	484,287
- Reduced jet fuel consumption	0.3%
Greenhouse gas emissions (Tonnes of carbon dioxide)	
- Before implementing the baseline measure	509,686,600
- After implementing the measures	508,156,254
- Reduced greenhouse gas emissions	1,530,346
- Reduced greenhouse gas emissions	0.3%
Fuel Efficiency Improvement	0.3%
Remark: The figures that are shown in the table are rounded results.	

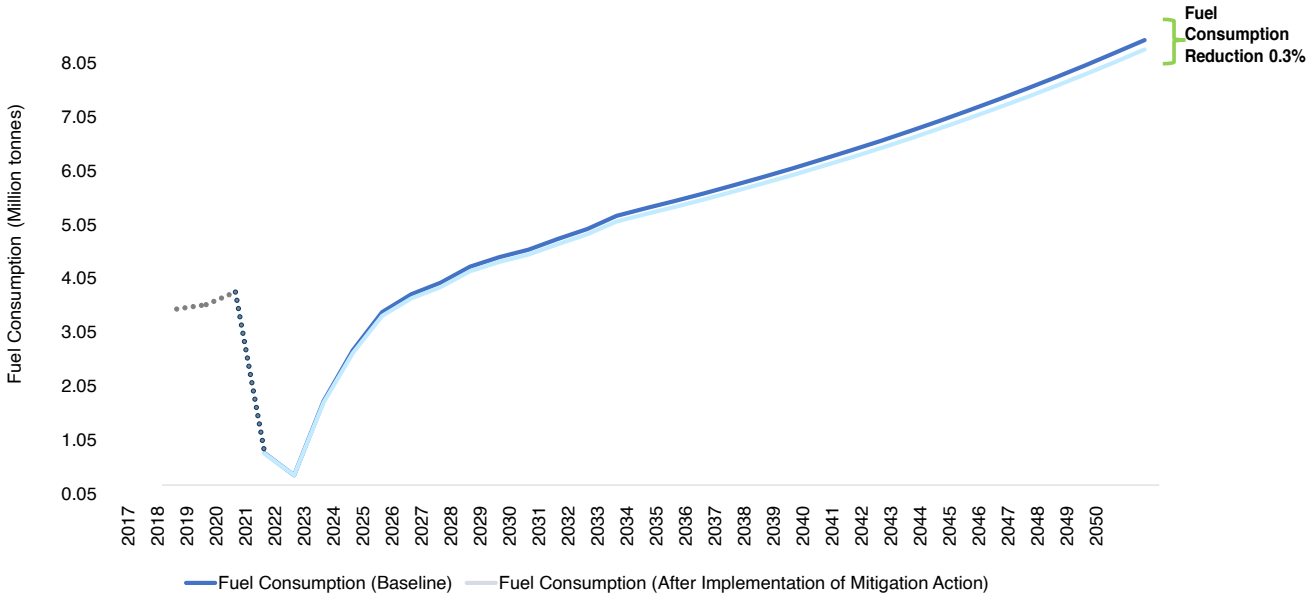


Figure 6: Expected results of international aviation fuel consumption in 2021 - 2050, compared to the baseline

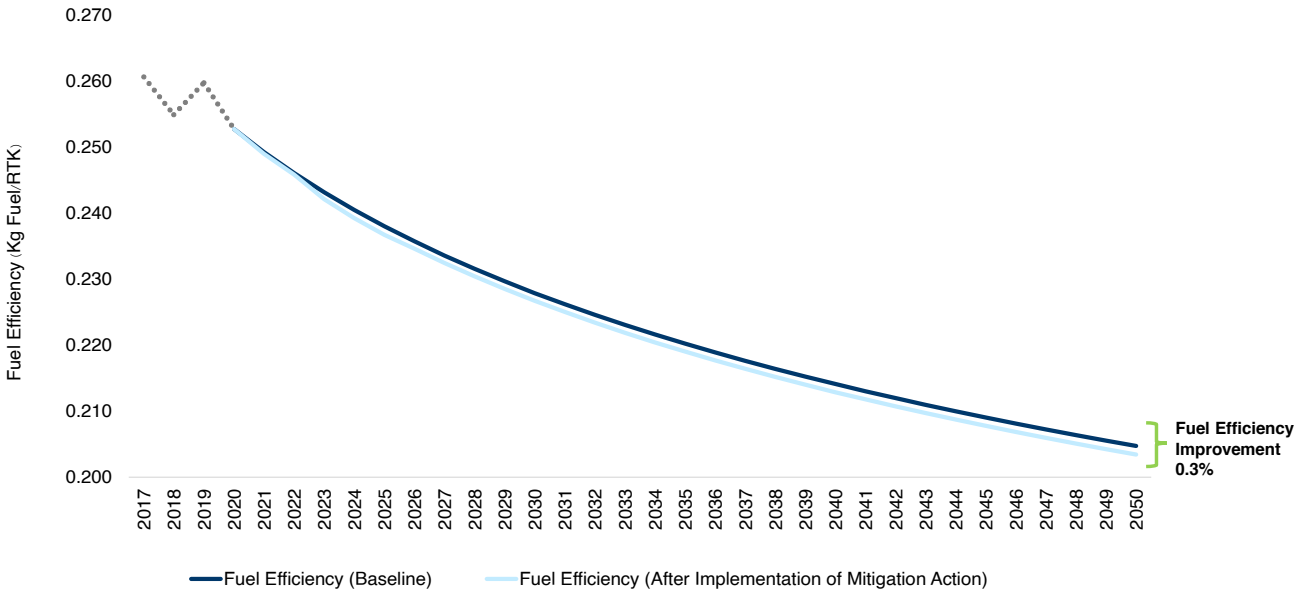


Figure 7: Expected results of international aviation fuel efficiency in 2021 - 2050, compared to the baseline

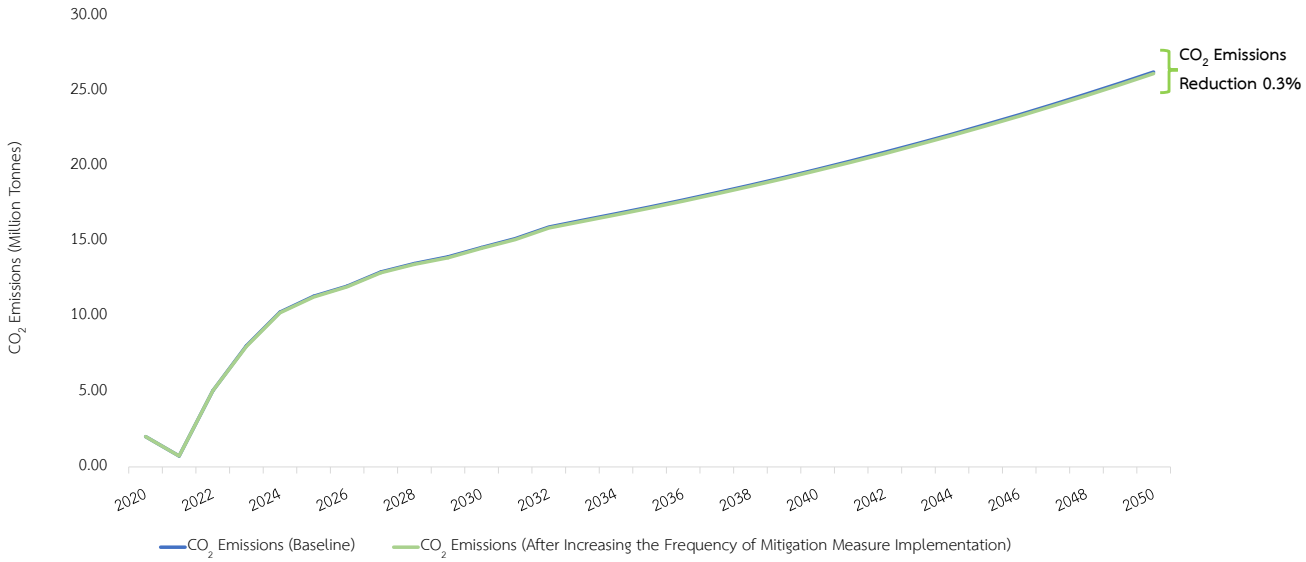


Figure 8: Expected results of international aviation CO_2 emissions in 2021 - 2050, compared to the baseline

Table 5: Expected Results data on energy consumption and greenhouse gas emissions in the international aviation sector for 2021 - 2050

Year	Fuel Consumption		CO_2 Emissions (Tonnes)	RTK (Tonne-Kilometers)
	(Liters)	(Tonnes)		
2021	288,721	230,977	729,887	927,282
2022	2,002,427	1,601,941	5,062,135	6,514,082
2023	3,173,020	2,538,416	8,021,396	10,471,543
2024	4,059,374	3,247,499	10,262,097	13,552,952
2025	4,473,023	3,578,419	11,307,803	15,090,204
2026	4,741,264	3,793,011	11,985,915	16,140,060
2027	5,113,410	4,090,728	12,926,701	17,566,830
2028	5,333,402	4,266,721	13,482,840	18,481,791
2029	5,508,280	4,406,624	13,924,932	19,245,091
2030	5,755,352	4,604,282	14,549,531	20,265,914
2031	5,986,406	4,789,125	15,133,636	21,236,992
2032	6,288,997	5,031,198	15,898,584	22,469,687
2033	6,465,189	5,172,151	16,343,998	23,257,028
2034	6,636,964	5,309,571	16,778,246	24,031,399

Table 5: Expected Results data on energy consumption and greenhouse gas emissions in the international aviation sector for 2021 - 2050 (Continue)

Year	Fuel Consumption		CO_2 Emissions (Tonnes)	RTK (Tonne-Kilometers)
	(Liters)	(Tonnes)		
2035	6,815,049	5,452,039	17,228,444	24,831,554
2036	6,999,570	5,599,656	17,694,913	25,658,350
2037	7,190,666	5,752,533	18,178,003	26,512,676
2038	7,388,488	5,910,790	18,678,097	27,395,448
2039	7,593,197	6,074,558	19,195,602	28,307,613
2040	7,804,966	6,243,973	19,730,955	29,250,149
2041	8,023,978	6,419,183	20,284,617	30,224,068
2042	8,250,426	6,600,340	20,857,076	31,230,415
2043	8,484,510	6,787,608	21,448,843	32,270,270
2044	8,726,445	6,981,156	22,060,454	33,344,747
2045	8,976,452	7,181,161	22,692,470	34,455,001
2046	9,234,761	7,387,809	23,345,476	35,602,222
2047	9,501,614	7,601,291	24,020,081	36,787,641
2048	9,777,262	7,821,810	24,716,919	38,012,531
2049	10,061,966	8,049,573	25,436,650	39,278,204
2050	10,355,996	8,284,797	26,179,957	40,586,019
Remark: The figures that are shown in the table are rounded results.				

5.4 Thailand's Stakeholder Engagement

CAAT, the agency that regulates civil aviation of Thailand, serves to drive and support stakeholders in the aviation industry to take action to reduce aviation fuel consumption and greenhouse gas reductions in Thai aviation sectors. These can be carried out by preparing participatory action guidelines in case the implementation of the plan deviates from the target through organizing an annual engagement meeting to present the annual results, disseminate, and clarify to the stakeholders involved in pointing out the success that all stakeholders participate in. It also serves to create an incentive for stakeholders to see the importance of the implementation of the action plan to achieve the target value set for the next year. This includes conducting meetings with specific aviation stakeholders to understand the situation, limitations, and other environmental factors which resulted in the aviation stakeholders unable to operate according to the goals that have been set or may use the aforementioned meeting as a means of reaching an agreement with aviation stakeholders to implement additional measures.

APPENDIX

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Appendix A Updates on Mitigation Measures in the 2013 Action Plan

No.	Mitigation Measures	Stakeholders	Year 2020	
			Status	Details
1	Modification of B777 aircrafts	Thai Airways International Public Co., Ltd.	Execution Accomplished	-
2	Purchase of new aircraft/ Buy new Airbus 320-200 NEO	Thai AirAsia Co., Ltd.	Currently in Progress	Depending on the flight duration, jet fuel consumption can be reduced by about 15 - 17% compared to A320-200 aircraft.
3	Gate hold procedure	Aeronautical Radio of Thailand Ltd.	Developed into an iDEP system	It was incorporated into an iDEP system as part of A-CDM operated at Suvarnabhumi Airport and Don Mueang Airport.
4	Parallel route/uni-directional route/CDR Route	Aeronautical Radio of Thailand Ltd.	Currently in Progress	-
5	Minimizing weight: Retune flight planning system	Thai Airways International Public Co., Ltd.	Currently in Progress	-
6	Minimizing weight: Reduce portable water quantity in aircraft	Bangkok Airways Public Co., Ltd.	Currently in Progress	-
		Thai Airways International Public Co., Ltd.	Currently in Progress	-
7	Aircraft wash and engine Wash	Thai Airways International Public Co., Ltd.	Currently in Progress	-
		Thai AirAsia Co., Ltd.	Currently in Progress	The measure execution depends on the cycle of aircraft maintenance scheduled with the aim for reducing the friction coefficient.

Appendix A Updates on Mitigation Measures in the 2013 Action Plan

No.	Mitigation Measures	Stakeholders	Year 2020	
			Status	Details
8	Single engine taxi	Bangkok Airways Public Co., Ltd.	Currently in Progress	-
		Thai AirAsia Co., Ltd.	Currently in Progress	-
9	Use of GPU during light maintenance and overnight maintenance	Thai AirAsia Co., Ltd.	Currently in Progress	The number of Auxiliary Power Unit (APU) usage hours increased due to insufficient parking holes at Don Mueang Airport. Night-time parking is required to park at a remote bay and then the aircraft is towed to the aerobridge, so the APU is used to enable communication with the aircraft control tower.
10	Full use of RNAV and RNP APP to cut tracks	Thai AirAsia Co., Ltd.	Currently in Progress	It is in the process of obtaining permission to proceed from the CAAT.
11	Use of ETOP operation	Thai AirAsia Co., Ltd.	Currently in Progress	Routes across the Indian Ocean, such as the Maldives and India routes are operated.
12	Air temperature is set at 25°C	Airports of Thailand Public Company Limited	Execution Accomplished	-
13	Lighting Control System	Airports of Thailand Public Company Limited	Execution Accomplished	-

Appendix B Updates on Mitigation Measures in the 2018 Action Plan

No.	Mitigation Measures	Stakeholders	Year 2020	
			Status	Details
1	Continuous Descents Operation (CDO)	Aeronautical Radio of Thailand Ltd.	Currently under Revision	-
2	Purchase of Airbus A350	Thai Airways International Public Co., Ltd.	Execution Accomplished	-
3	Reduce flap landing	Bangkok Airways Public Co., Ltd.	Currently in Progress	It was implemented for Airbus aircraft fleet.
		Thai AirAsia Co., Ltd.	Currently in Progress	Every operation was able to reduce the use of jet fuel by 12-15 kg (as specified by Airbus).
4	Electronic Flight Bag (EFB)	Bangkok Airways Public Co., Ltd.	Currently in Progress	It was already authorized by CAAT.
5	Seat retrofit	Bangkok Airways Public Co., Ltd.	Execution Canceled	-
6	Construction of new runway at Suvarnabhumi airport	Airports of Thailand Public Co., Ltd.	Currently in Progress	The EHIA report was approved by Office of National Environmevnt Board (ONEB).
7	Airport Collaboration Decision Making (CDM)	Airports of Thailand Public Co., Ltd.	Currently in Progress	The working committee was established at Suvarnabhumi Airport and Don Mueang Airport.
8	CORSIA	Civil Aviation Authority of Thailand	Currently in Progress	-
9	Ground Delay Program	Aeronautical Radio of Thailand Ltd.	Currently in Progress	It was implemented at the regional level in the countries where Calculated Take-Off Time (CTOT) data can be shared.

Reference

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[19] Remark: The data collection period for the plan is not yet aware of the timeframe of the expansion or additional plans. However, expansion or additions may be implemented in the future.

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CAAT
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The Civil Aviation Authority of Thailand